THE MINNEAPOLIS SEED MATHEMATICS SPECIALIST PROJECT

THE PILOT 1970-71
WILLARD SCHOOL
MINNEAPOLIS PUBLIC SCHOOLS

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I. The Seed Mathematics Specialist Program Project is a program in which persons highly trained in mathematics (university level mathematicians, mathematics educators and advanced graduate students in mathematics and mathematics education) teach conceptually oriented mathematics to full size classes of elementary children on a daily basis. This program has been operating in Willard School during the 1970-71 school year. During this time 4 professors, three mathematicians, 1 educator from the University of Minnesota have been involved with the teaching of mathematics to full-size classes of Willard students on a daily basis. In early February 1971 two additional Seed classrooms were identified in the Willard School. One of these was taught by a mathematician, the other by a graduate student in mathematics education both from the University of Minnesota. These latter classes are involved in a small scale pilot research project which is attempting to determine the effectiveness of the Seed program. Pre-test data has been collected and control classrooms within Willard School have been identified. The results of the data analysis are contained in this report. All classrooms involved in the Mathematics Specialist Program for the 1971-72 school year will be involved in a large scale research project with appropriate controls identified This report details the recommendations of the persons involved with the 1970-71 Seed Mathematics Program as to the nature of the program for the 1971-72 school year.

II. Objectives of the Mathematics Specialist Program

A. To improve the self image of the inner-city student: It is hoped that successful experiences in a high status subject such as algebra or coordinate geometry will result in both increased motivation and achievement in other subject areas as well as a more positive perspective as to one's own intellectual capabilities.

B. To raise expectations of teachers of inner-city students: It is hoped that teachers seeing their students succeed in a subject area such as algebra or coordinate geometry will ultimately expect a better performance from their students in other subject areas.

C. To identify hidden ability: Conceptually oriented mathematics taught from a discovery point of view offers the teacher an unparalleled opportunity to view the inner-city child's raw intelligence which is rarely revealed by standardized test measures.

D. To gain further knowledge of the limits of the elementary school child's ability to comprehend abstract mathematical concepts. The instructors who would teach in this project are mathematically trained at the level not only more advanced than that of the average elementary and secondary school teacher, but also at a level at or above a large percentage of college level teachers of mathematics. Their specialized knowledge enables them to lead the child into mathematical areas seldom before presented to elementary school children.

E. To further develop relationships between the university community and the public school systems.

III. General Program Requirements:

A. The regular classroom teacher should be present at all times while the Seed Mathematics is being taught to his students. The experience would provide some degree of in-service training as well as help to raise the general level of his expectations for student achievement. This presence, also eliminates the necessity of the mathematics consultant's being credentialed to teach in the elementary school.

B. An absolutely necessary condition for the success of the program is the use of the discovery method. A discovery method of teaching Mathematics necessitates in turn a teacher who is very well trained in the subject area. Even second graders ask very profound questions.

C. The mathematics should be taught four or five days per week for approximately 30 to 40 minutes each day.

D. The intact class should be selected for this program in terms of imagination, creativity, and intellectual curiosity--not in terms of IQ or other standardized scores. Their earlier teachers, who, by experience, are best equipped to do so, should decide on the basis of the above criteria, which groups will comprise the initial classrooms. It is also essential that the classroom teachers involved by sympathetic to the objectives of this program, for without their firm support, this project will surely fail.

E. Proposed time schedule for the 1971-72 Project: Classroom instruction will begin approximately four weeks following the opening of the Minneapolis Public Schools for the 1971-72 school year.

Design

Setting: The pilot study was conducted in the Willard Elementary School. The Willard School is an inner-city school located in the North Pyramid area of the Minneapolis Public School System. The large majority of students in the Willard School come from low income family situations. Approximately 65% of Willard students are black. Willard's principal, Mr. Herbert Karsten, indicated that this school has an annual student turn-over rate in excess of 100%. A large majority of Willard students have been identified as educationally disadvantaged. Educationally disadvantaged students are defined as those who score one or more years below grade level on standardized achievement tests in reading and mathematics. Despite these factors, it is this writers opinion that the Willard school does not conform to the stererotypic target area inner-city elementary school situation. Although problems do exist, the school is extremely well administered. Many of the Willard professional staff have received special training in inner-city education and appear to be specially competent in their professional roles. (This can be said with more authority with respect to the five teachers who participated in the mathematics specialist project during the 1970-71 school year) Principal Karsten's campaign for "Willard Pride" has resulted in a school cohesiveness and generally positive attitude toward learning on the part of the student body. Many of Willard's students were found to be interested, capable and enthusiastic relative to the pursual of intellectually oriented activities. In summary, Willard was felt to be an ideal place to conduct such a pilot program.

Sample

As mentioned above there were five experimental classrooms which housed the pilot program for the 1970-71 school year. Three of these classrooms began in mid-October 1970 and continued through late May of 1971. The remaining two classrooms began late January 1971 and continued through late May 1971. Objective data has been collected on the latter two classes. Because of a lack of comparative data no objective analysis was performed on the classrooms which began in October of 1970. However, subjective evaluations by teachers and project personnel appear in appendix F.

In December of 1970 it was determined that additional financial aid would be available to begin two additional SEED classrooms in the month of January 1971. Teachers interested in participating in this controlled phase of the pilot study were identified and randomly assigned to experimental or control groups. In addition the two new Seed teachers were randomly assigned to experimental groups. Identical pre and post testing conditions were imposed on the (two experimental and two control) classrooms involved in the pilot study.

Personnel

All Seed personnel were highly trained in the area of mathematics. All have classroom teaching experience, although the professors of mathematics have not previously had elementary classroom teaching experience. It is believed that all personnel shared a committment to the mathematics education of elementary school children and all individuals believed in the potential of a project of this type. The project personnel were:

*Sharon Curnow - Graduate Student, Mathematics Education
University of Minnesota

*Eugene Fabes - Associate Professor, Department of Mathematics,
University of Minnesota

Hillel Gershenson - Associate Professor, Department of Mathematics,
University of Minnesota

Harvey Keynes - Associate Professor, Department of Mathematics, University of Minnesota
Thomas R. Post - Associate Professor, Mathematic Education, Division of Elementary Education, University of Minnesota
Leonard Shapiro - Assistant Professor, Department of Mathematics, University of Minnesota

* Indicates Teachers of classrooms analyzed in this report

Treatments

All Seed classrooms were involved in Mathematics Instruction for 30 to 40 minutes four days per week. The fifth day was spent by Seed instructors observing one another's teaching and consulting with other project personnel. This instruction did not replace the "normal" mathematics instruction of the Willard school of students in the experimental classes. Seed students in effect received nine sessions of instruction in mathematics per week. (five in arithmetic and four Seed mathematics). The atmosphere in experimental classrooms was informal, relying principally on discovery oriented teaching techniques. Project Personnel conscienously attempted to avoid extensive exposition. The posing of Leading questions followed by student involvement was in general, the instructional format utilized. Formal tests were not given, however, instructors attempted to ascertain the effectiveness of previous classes by encouraging students to provide a short verbal review of the provious days activities. By this procedure instructors were able to approximate the extent of student conceptual attainment.

At all times student responses were respected and accepted. "Better to have students incorrect responses than the teacher providing correct answers" was the philosophy adhered to. In the event of incorrect responses (which frequently occurred) other class members were encouraged to react and clarify. Rarely did the instructors find it necessary to correct an incorrect student response.

Although the factor of mathematical content was not standardized across experimental classrooms, there were general categories in which all classrooms became involved. These include (1) exponentiation; (2) language of sets;

(3) sign numbers and operations on them using the number line; (4) solutions to simple linear equations, (5) structural principles - i.e. associative, commutative and distributive laws, inverse and identity elements; (6) topology - "run through houses" (similar to Koenigsburg Bridge Problem). In addition, several of the following topics were also considered by three groups meeting for the entire school year. (1) graphing of linear functions, (2) mathematical groups, (3) fractions as solutions of equations and placement of fractions on number line, (4) the multiplicitive slide rule, (5) graphical solution of simultaneous linear equations, and (6) finite series and resulting computations.

This list of mathematical topics, although perhaps impressive, should not be construed as implying that all or even most students have "mastered" all phases of the topics under consideration. It was felt, however, that the majority of the students did in fact comprehend many of the main ideas embedded in these topics.

Homework was not generally assigned although there was some variation in both amount and frequency of this factor from class to class.

Subjective Evaluation of the Seed instructors indicates that on the average between 50 and 75% of the students were attentive to the instructional situation. It was further determined that this 50-75% was not always comprised of the same students. Most students would "drop-in" and "drop-out" several times during a class period. There were times when normally attentive students were completely unconcerned with the mathematics instruction. Clearly there were uncontrolable variables influencing the degree of student participation.

Limitations

Due to a lack of precise control of the major experimental variables this pilot endeavor can not be interrupted as a true experimental study. The "loosely constructed" design utilized, prohibits a cause and effect interpretation of the

data analysis. The following are viewed as the major limitations which prohibit such a cause and effect interpretation: (1) inability to randomly assign students to experimental or control treatments, thus mandating the utilization of the classroom as the experimental unit. (2) small number of experimental units utilized in data analysis (two experimental, two control). (3) content variability in experimental classroom instruction. (4) lack of control of teacher variable - although all instructors attempted to utilize mainly the discovery approach, individual differences in pedagogical technique surely exists.

Testing Procedures 1970-71

Three basic evaluative instruments were utilized. 1) The Modern Mathematics Supplement to the Iowa Test of Basic Skills; 2) Mathematics Attitudinal Inventory; and 3) the Cooper-Smith Self-Esteem Inventory. All are appended to this report.

The Iowa Test of Basic Skills - this test, which was part of the Willard Schools test battery, was utilized in an attempt to identify changes in mathematical achievement occurring simultaneously with the administration of the mathematics specialist program. In all cases the investigator is interested in determing whether/or not associated with the program decided improvements occur. This is very much different from implying a direct cause and effect relationship. Although the prime objective of the program was not to improve the child's achievement in the regular mathematics program (defined here as his score on the Iowa Test of Basic Skills) limited evaluative evidence from other SEED projects have indicated that such a change is likely to occur. All Iowa Tests of Basic Skills were administered by the classroom teacher under normal classroom

conditions. Students answered only those questions identified as appropriate to their particular grade level.

The Cooper-Smith Self Esteem Inventory - The primary objective of this project as stated in the first section of this report is to improve the self-concept of inner-city youth. In the fall of 1970 the Cooper-Smith Self-Esteem Inventory was identified as an instrument attempting to quantify one's feeling of self-worth. The instrucment consisted of 58 items to which the student would respond "like me" or "not like me". Subjects in experimental and control groups were removed from their regular classrooms and this test administered to them in groups of three or four individuals. The Test administrators were research assistants employed by TTT and graduate teaching assistants of the major investigator. The oral feedback received by test administrators was not encouraging. The extensive time (about 45 minutes) needed to administer this instrument was felt to be far in excess of reasonable standards. The structure of the questions itself did not appear to be geared toward the age or ability levels of the Willard Students under consideration. The tests were administered orally (although each had a copy of the test in front of him) and students were asked to mark answer sheets which were placed in front of them. Feedback indicates that student involvement in this evaluative procedure varied from complete indifference to comments such as "that's none of your business" in response to several of the questions in this inventory. The fact that students were removed from the familiar classroom setting and given this test by a relative stranger is but one factor which raises serious questions as to the validity of the responses collected. Although the scores on the Cooper-Smith are presented in another section of this report, the investigator urges extreme caution in their interpretation.

For the 1971-72 school year a second self-esteem inventory has been identified. This instrument appears to be far simplier in its construction and is concerned only with self concept as learner. This test will be administered in the regular classroom situation by Willard's principal, Mr. Karsten. It is felt that this arrangement for the 1971-72 school year insofar as the administration of a self-esteem inventory is concerned is far superior to the procedure outlined for the 1970-71 effort. It is far more likely therefore, that the data gained during the current school year will provide a more accurate indication of any changes in student self-esteem. It must further be pointed out that this illusive hypothetical construct may not at this time be measurable with any available instrument. This suspicion is certainly an inhibiting factor when one's concern is an assessment of measurable changes in this factor.

Mathematics Attitude Scale - the attitude scale utilized was a modified version of the Wilbur H. Dutton scale[1]. This instrument has been normed for junior highschool pupils. Items were re-written so as to be more in keeping with the elementary students thinking. Although no normative data exists for this instrument as utilized, the investigator appeals to face validity as the primary justification for its relevance and utilization. There is no reason to believe that students would respond in any but an honest manner to the straight-forward questions included in this inventory.

NOTE: For the 1971-72 school year the attitude inventory used replaced the word "arithmetic" with the word "mathematics". This has been done for the 71-72 school year because of the fact that the word mathematics more aply describes the content in the ongoing mathematics specialist classrooms.

[1]Dutton, W. H., Attitudes of Junior Highschool Pupils Toward Arithmetic. School Review 64, 1956, 18-22.

Analysis of Data:

As indicated earlier data from 4 classrooms (2 experimental, 2 control) was collected and is the basis for analysis in this section of the report. Hence forth each of these classrooms will be referred to by a cell number. These cells are defined as follows:

Cell 1 - 3rd Grade - Experimental
Cell 2 - 4th Grade - Experimental
Cell 3 - 3rd Grade - Control
Cell 4 - 4th Grade - Control

Cell descriptions indicate a two factor (Treatment, and grade level) design which can also be depicted in tabular form.

	Grade 3	Grade 4
Experimental	Cell #1	Cell #2
Control	Cell #3	Cell #4

Six scores have been compiled for each individual within each cell. They are designated in the following manner:

IA PR Iowa Tests of Basic Skills Arithmetic Pre Test

IA PO Iowa Tests of Basic Skills Arithmetic Post Test

SE PR - Coopersmith Self Esteem Inventory Pre Test

SE PO - Coopersmith Self Esteem Inventory Post Test

AA PR - Arithmetic Attitude Inventory Pre Test

AA PO - Arithmetic Attitude Inventory Post Test

The three pre-test scores are considered the independent variables. The three post test scores are considered the dependent variables.

A total of 84 students participated in the pilot study. They are distributed as in Table 1.

Table 1

CELL IDENTIFICATION AND FREQUENCIES

CELL	FACTOR LEVELS		N
	TREAT	GRADE	
1	Experimental	3	19
2	Experimental	4	21
3	Control	3	23
4	Control	4	21

TOTAL N= 84

Observed cell means and cell standard deviations for the 3 independent and 3 dependent variables are found in Tables 2 and 3 respectively.

Table 2

OBSERVED CELL MEANS --- ROWS ARE CELLS - COLUMNS ARE VARIABLES

CELL	1 IA PR	2 IA PO	3 SE PR	4 SE PO	5 AA PR	6 AA PO
1	12.89474	14.36842	68.57895	61.68421	3.42105	3.73684
2	9.61905	12.61905	62.47619	63.28571	1.66667	2.95238
3	15.91304	14.95652	67.13043	59.82609	1.04348	1.69565
4	9.85714	14.57143	73.23810	72.23571	5.38095	4.19048

Table 3

OBSERVED CELL STD DEVS -- ROWS ARE CELLS - COLUMNS VARIABLES

CELL	1 IA PR	2 IA PO	3 SE PR	4 SE PO	5 AA PR	6 AA PO
1	4.12169	6.54226	11.28576	10.31209	4.01823	3.70948
2	4.49974	5.25810	13.28013	17.41592	6.06905	3.68071
3	5.55070	7.10620	14.13347	12.43036	2.47677	3.86634
4	5.72962	6.71991	11.12612	10.88643	4.42127	5.73253

Observed combined means by factors (Treatment and Grade Level) are contained in Table 4.

Table 4

OBSERVED COMBINED MEANS

FACTORS 1 (TREAT)

LEVEL Experimental
N = 40

MEANS	IA PR = 11.17	SE PR = 65.37	AA PR = 2.500
	IA PO = 13.45	SE PO = 65.52	AA PO = 3.325

LEVEL Control
N = 44

MEANS	IA PR = 13.02	SE PR = 70.05	AA PR = 3.114
	IA PO = 14.77	SE PO = 65.77	AA PO = 2.886

FACTORS 2 (GRADE)

LEVEL 3
N = 42

MEANS	IA PR = 14.55	SE PR = 67.79	AA PR = 2.119
	IA PO = 14.69	SE PO = 60.67	AA PO = 2.619

LEVEL 4
N = 42

MEANS	IA PR = 9.738	SE PR = 67.86	AA PR = 3.524
	IA PO = 13.60	SE PO = 67.79	AA PO = 3.571

All statistical analysis was performed by the CDC 6600 computer at the University of Minnesota. The budget number for this job was 30076033. The J. D. Finn program was utilized. This program provides unvariate and multivariate analysis of variance, covariance and regression based on a model of rank 4 (General Mean, Iowa post test, Self Esteem Post Test, and Arithmetic Attitude post test) means were estimated for each cell. This was done for each of the dependent variables (post test) while using the corresponding independent variable (pre-test) as a

covariate. These means were then combined both within and between treatments. It is upon these estimated combined means that the principle analysis was performed (See Tables 7, 8 and 9). Table 5 delineates the estimated combined means which resulted from this process. For subsequent analysis these means were further combined and form the entries for column 1 in Tables 7 and 8.

Table 5

ESTIMATED COMBINED MEANS BASED ON FITTING A MODEL OF RANK 4

FACTORS 1 (TREAT)

LEVEL 1				
	MEANS	IA PR = 11.26	SE PR = 65.53	AA PR = 2.544
	- - - - -	IA PO = 13.49	SE PO = 62.48	AA PO = 3.345
LEVEL 2				
	MEANS	IA PR = 12.89	SE PR = 70.18	AA PR = 3.212
	- - - - -	IA PO = 14.76	SE PO = 66.06	AA PO = 2.943

- -

FACTORS 2 (GRADE)

LEVEL 1				
	MEANS	IA PR = 14.40	SE PR = 67.85	AA PR = 2.232
	- - - - -	IA PO = 14.66	SE PO = 60.76	AA PO = 2.716
LEVEL 2				
	MEANS	IA PR = 9.738	SE PR = 67.86	AA PR = 3.524
	- - - - -	IA PO = 13.60	SE PO = 67.79	AA PO = 3.571

The contrasts made are depicted by Table 6.

Table 6

ORTHOGONAL CONTRAST VECTORS UTILIZED

Comparison	Cell 1	Cell 2	Cell 3	Cell 4
1.	.5	.5	-.5	-.5
2.	.5	-.5	.5	-.5
3.	.25	-.25	-.25	.25

Comparison	Code	Meaning
1.	$\frac{\bar{X}_1 + \bar{X}_2}{2}$ *[1] $\frac{\bar{X}_3 + \bar{X}_4}{2}$	Experimental * Control
(Refer to Hypotheses 1, 2 and 3)	(Subscripts refer to Cell numbers)	Combined means (across grade level) for IA PO, SE PO and AA PO
2. (Refer to Hypotheses 4, 5 and 6)	$\frac{\bar{X}_1 + \bar{X}_3}{2}$ * $\frac{\bar{X}_2 + \bar{X}_4}{2}$ (Subscripts refer to Cell numbers)	Third grade * Fourth grade combined means (across treatments) for IA PO, SE PO and AA PO
3. (Refer to Hypotheses 7)		Treatment by grade level interaction for IA PO, SE PO and AA PO

Analysis was performed on cell means for each of the dependent variables (IAPO, SEPO and AAPO) using their respective pre-tests as covariates.

The Null Hypothesis Tested were:

1. There exists no statistically significant difference in post test combined means (across grade levels) on the Arithmetic Scores of the Iowa Test of Basic Skills between Experimental and Control groups. $\left[\frac{\bar{X}_1 + \bar{X}_2}{2}\right.$ compared with $\left.\frac{\bar{X}_3 + \bar{X}_4}{2}\right]$ where subscripts refer to cell numbers.

[1] * is read "compared with"

2. There exists no statistically significant difference in post test combined means (across grade levels) on the Coopersmith Self Esteem Inventory between Experimental and Control groups.

3. There exists no statistically significant difference in post test combined means (across grade levels) on the Arithmetic Attitude Inventory between Experimental and Control groups.

4. There exists no statistically significant difference in post test combined means (across treatments) on the Arithmetic Scores of the Iowa Test of Basic Skills between the third and fourth grade students in this study $\frac{\bar{X}_1 + \bar{X}_3}{2}$ compared with $\frac{\bar{X}_2 + \bar{X}_4}{2}$ where subscripts refer to cell numbers

5. There exists no statistically significant difference in post test combined means (across treatments) on the Coopersmith Self Esteem Inventory between the third and fourth grade students in this study.

6. There exists no statistically significant difference in post test combined means (across treatments) on the Arithmetic Attitude Inventory between the third and fourth grade students in this study.

7. There exists no statistically significant treatment by grade level interaction effect with respect to any of the three dependent variables (IA PO, SE PO, AA PO)

For purposes of this study, F ratios were not considered statistically significant unless they attained or surpassed the value required for the .05 level of significance using the appropriate numbers of degrees of freedom.

Tables 7, and 9 contain the principal data analyses.

Table 7

UNIVARIATE ANALYSIS OF VARIANCE FOR THREE DEPENDENT VARIABLES: CONTRASTING EXPERIMENTAL AND CONTROL ESTIMATED COMBINED MEANS ACROSS GRADE LEVEL.[1] ONE COVARIATE HAS BEEN ELIMINATED.[2]

	Estimated Combined Means	Hypotheses Mean square M.S.	Error term	df	F	P
Experimental IA PO	14.10	.0401	28.0719	(1,79)	.0014	.9700
Control IA PO	14.16					
Experimental SE PO	63.58	22.3882	138.5506	(1,79)	.1616	.6888
Control SE PO	64.96					
Experimental AA PO	3.447	8.2034	17.1888	(1,79)	.4773	.4917
Control AA PO	2.840					

As can be seen from Table 7 univariate F ratios are small and hence their corresponding probabilities are not significant. Hypotheses 1, 2 and 3 cannot be rejected. There is no evidence to support the notion that associated with experimental treatment was an increase in student performance on

a) Arithmetic Scores on the Iowa Test of Basic Skills

b) Coopersmith Self Esteem Inventory

or c) Arithmetic Attitude Inventory

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[1] Combined means estimated: based on fitting a model of Rank 4.

[2] In each case, the covariate for a set post-test scores is corresponding set of pre-test scores.

Table 8

UNIVARIATE ANALYSIS OF VARIANCE FOR THREE DEPENDENT VARIABLES: CONTRASTING GRADE THREE AND GRADE FOUR ESTIMATED COMBINED MEANS ACROSS TREATMENTS. ONE COVARIATE HAS BEEN ELIMINATED.[3]

		Estimated Combined Means	Hypotheses Mean Square	Error term	df	F	P
1.	Grade Three IA PO	12.94	103.7285	28.0719	(1,79)	3.6951	.0582
	Grade Four IA PO	15.32					
2.	Grade Three SE PO	60.76	1071.5201	138.5506	(1,79)	7.3338	.0068
	Grade Four SE PO	67.79					
3.	Grade Three AA PO	2.915	4.9286	17.1888	(1,79)	.2867	.5939
	Grade Four AA PO	3.373					

Regarding Number 1 in Table 8 (Hypothesis 4)

The maximum third grade arithmetic score on the Iowa Test of Basic Skills (Modern Mathematics Supplement) is 30 (1 point for each correct item.) The Maximum score attainable for fourth grade students is 36. Questions 16 and 30 are contained in both test (the latter part of the third grade test and the first part of the fourth grade test). Test items are generally numbered in increasing order of difficulty such that only the more capable (say upper quartile normed nationally) will complete the latter items at each grade level. Normative test data[4] indicates that third grade students in this study ($\bar{X}$ = 12.94) have a

[3]In each case, the covariate for a set post-test scores is corresponding set of pre-test scores.

[4]Modern Mathematics Supplement to the Iowa Tests of Basic Skills Manual for Administration and interpretation p. 19.

mid year grade equivalent of 3.1. In a similar fashion fourth grade students ($\bar{X}$ 15.32) have a mid year grade equivalent of 4.0. Both groups being approximately one-half year behind the national norm. This point is made to indicate that it is highly unlikely that a given student(s) was able to complete (or even attempt) items in the last third or fourth of this instrument. Thus a comparison of means between grade levels is reasonable in this case despite the fact that the possible attainable scores differ by 6.

Although the obtained F ratio of 3.6951 did not attain significance at the .05 level of confidence, the P value of .0582 is worthy of note. It appears that third grade students (across treatments) did relative less well than fourth grade students in the area of arithmetic achievement as measured by the Iowa Test.

Regarding #2 in Table 8 (Hypothesis 5)

The obtained F value of 7.3338 and its corresponding P value of .0068 far exceed the levels necessary for statistical significance in this study. A literal interpretation of this information would indicate that fourth grade students had a higher self-esteem following the experimental period than third grade students. It is necessary at this point to remind the reader of comments made previously when the Coopersmith Self Esteem Inventory was discussed. To reiterate, it was felt that this instrument was not wholly appropriate for the population of students considered in this study. In fact for the 1971-72 school year a seemingly more appropriate instrument has been utilized. These results are presented here solely to provide a comparison for the obtained scores on the self-esteem instrument utilized during the 1971-72 school year. They should be interpreted in no other way.

Regarding # 3 in Table 8 (Hypothesis 6)

Results not significant. There appears to be no tangible difference in attitudes towards arithmetic between the third and fourth grade students considered.

Table 9

UNIVARIATE ANALYSIS OF VARIANCE FOR TREATMENT BY GRADE LEVEL INTERACTION EFFECT FOR THREE DEPENDENT VARIABLES. 1 CORVARIATE HAS BEEN ELIMINATED.[5]

Dependent Variable	Hypothesis Mean Square	Error Term	df	F	P
IA PO	59.9956	28.0719	(1,79)	2.1372	.1478
SE PO	128.9728	138.5506	(1,79)	.9309	.3376
AA PO	9.1878	17.1888	(1,79)	.5345	.4669

Analysis throughout this report has assumed that the following linear model accurately represents the components of obtained scores.[6]

$$Y = \mu + \alpha + \beta + \alpha\beta + \epsilon$$

where

Y = Obtained Student's Score

μ = General Mean

α = Treatment Effect

β = Grade Level Effect

$\alpha\beta$ = Treatment by Grade Level Interaction Effect

ϵ = Residual or error effect

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[5] In each case, the covariate for a set post-test scores is corresponding set of pre-test scores.

[6] Significant results on the tests for linear regression substantiate this assumption. ($F=39.89$, $p<.001$: $F=20.24$, $p<.001$ and $F=8.54$, $p<.0046$ for IA PO, SE PO and AA PO respectively using as covariate the corresponding set of pre-test scores).

Table 9 reports the results of testing the Hypothesis that ($\alpha\beta$) effect = 0. The obtained P values of .1478, .3376 and .4669 for IAPO, SEPO and AAPO respectively do not imply statistical significance. Hypothesis 7 therefore cannot be rejected. There was no discernable treatment by Grade level interaction effect for any of the dependent variables considered.

Conclusion:

If the major objective of this pilot endeavor was to elicit statistically significant differences in obtained mean scores, then the results were truly disappointing. Such was not the case however. The nature of the experimental design (or lack there of) precluded a cause and effect interpretation of differences even if they had been obtained. The Pilot effort was useful in that it alerted project personnel to many of the problems inherent in a program of this type as well as provided the opportunity to obtain invaluable classroom experience with young children. The plans for the 1971-92 school year (See appendix A) have attempted to eleviate and/or provide for many of the difficulties encountered during the pilot study.

There is a dimension to the pilot effort which to this point has not been adequately addressed. Realizing that subjective data is not, in and of itself, sufficient insofar as buttressing an intellectual position, the investigator feels that at this point in time that such evidence is worthy of the readers attention. During the 1970-71 school year many unquantifiable incidents occurred which are interpretable as supportive to the concept of this project. Such incidents include the enthusiastic acceptance of the project by classroom teachers and parents of Willard Students. Teacher reactions to the Specialist project are contained in Appendix F . At a Willard PTA meeting, involved parents voiced strong support for the continuation (and expansion) of the project in the Willard School. Project personnel continue to be enthusiastic

about the degree of acceptance and involvement which some students have shown. On a visit to Willard in September of 1971 the investigator, upon seeing several of his students from last year, inquired as to whether they felt last years experience was worth while. Responses were all affirmative with several of the students lamenting that fact that they did not have "Algebra" class again this year. Such incidents were not uncommon and many such occurred to all staff members during the 1970-71 school year. Such "evidence" does not officially find its way into a report such as this, but is nevertheless considered to be non-trivial. Project personnel believe something positive is happening at Willard. A major problem is the fact that we have not yet found an acceptable way in which to measure it quantitatively. When dealing with variables non-cognitive in nature (the self-esteem, attitudes) valid and reliable instruments are difficult to identify (Perhaps they do not exist). Much effort needs to be expended in developing such instruments.

At this point in time, all things taken into consideration, the following recommendations are felt to be appropriate.

Recommendations:

1. That the Project continue through the 1971-72 school year in Willard School. Continuation beyond June 1972 should be dependent upon the results of the evidence (objective and subjective) collected during the 1971-72 school year.
2. That efforts be expended by project personnel to develop an expanded outline of mathematical topics felt to be appropriate for a project of this type. Such an outline would prove invaluable to new personnel which the project might ultimately attract as well as serve to "standardize" treatment of mathematical content in ongoing project classrooms. (It is my understanding that this is currently being done.)

3. That project personnel attempt to more fully involve classroom teachers in Seed mathematics instruction. Regular classroom teachers for example might from time to time, teach an "algebra" class under the supervision of project personnel. Such a team effort could benefit both parties not to mention the students involved.
4. That each quarter of the school year a project coordinator be identified. His functions shall include: a) oversee the training and classroom instruction of new project personnel, b) coordinate classroom visits by interested outsiders, c) function as liason between project and school administration, d) function as liason between project and groups of interested parents and other local community members and e) coordinate project publicity. (See appendix D for examples of publicity during the 1970-71 school year)
5. That Willard administration and staff be commended for their excellent cooperation and strong support during the 1970-71 school year.

A P P E N D I X A

THE SETTING 1971-72

The Setting: 1971-72

Funds for the 1971-72 school year were procured from the Training of Teacher Trainers (TTT), The Center for Urban and Regional Affairs (CURA), and Title One Funds of the Minneapolis Public School System. The Willard School is again being used as the project site. It was felt that the 1970-71 school year was most beneficial in that it enabled project personnel to iron out many of the procedural and evaluative rough spots. It is felt that a more valid evaluation of the mathematics specialists project can be made by an analysis of the data collected during the 1971-72 school year. Continuation of the project beyond June 1972 should be dependent upon the identifiable results of the projects efforts during the current school year.

Three project classrooms were begun in October 1971. These classrooms will continue thru the current school year. During this time project personnel will attempt to attract and train other individuals in mathematics and mathematics education to become involved in the project beginning January 1972. If these efforts are successful the Willard School will have eight mathematics specialist classrooms in operation between January and June of 1972. It is expected that testing and procedural changes resulting from the 1970-71 experience will provide more valid objective information as to the efficiency of this project.

A P P E N D I X B

T E S T S U T I L I Z E D

a. IOWA TESTS OF BASIC SKILLS

b. SELF-ESTEEM INVENTORY (SEI)

c. SELF CONCEPT INSTRUMENT - A LEARNER SCALE

d. ARITHMETIC ATTITUDE SCALE

e. MATHEMATICS ATTITUDE SCALE

MODERN MATHEMATICS SUPPLEMENT TO THE

IOWA TESTS OF BASIC SKILLS

MULTI-LEVEL EDITION FOR GRADES 3-8/9

Prepared at the State University of Iowa
Under the Direction of
E. F. Lindquist, A. N. Hieronymus, and H. D. Hoover

Test X: Mathematics Concepts, Grades 3-6

Directions: This is a test of how well you understand the number system and the terms and operations used in mathematics.

Four answers are given for each exercise, but only one of these answers is right. You are to choose the one answer that you think is better than the others. Then, on the answer sheet, find the row of answer spaces numbered the same as the exercise. Fill in the answer space for the best answer.

The sample exercise at the right shows you how to mark your answers on the answer sheet.

SAMPLE EXERCISE

S1. What should replace the □ in $4 + 2 = \square$?

1) 7
2) 6
3) 4
4) 2

ANSWER

S1. ① ○ ③ ④

Use this table to find where your grade is to **begin** *and* **stop** *on this test.*

	BEGIN WITH	STOP AFTER
GRADE 3	Page 3, Exercise 1	Exercise 30, Page 5
GRADE 4	Page 4, Exercise 16	Exercise 51, Page 6
GRADE 5	Page 5, Exercise 31	Exercise 72, Page 8
GRADE 6	Page 7, Exercise 52	Exercise 96, Page 9

3 GRADE 3 BEGIN HERE

1. What is another name for 1 ten and 4 ones?
   1) Five
   2) Fourteen
   3) Ten four
   4) Forty-one

2. How many squares are shown below?

   1) 0
   2) 3
   3) 4
   4) 7

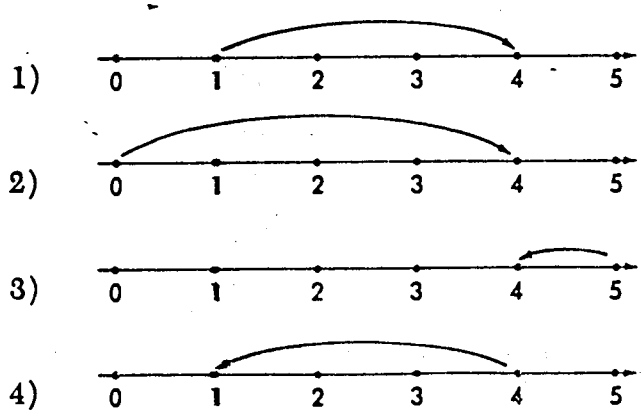
3. Which of these sets of coins has the greatest value?
   1) 2 quarters
   2) 4 dimes
   3) 9 nickels
   4) 26 pennies

4. What numeral will make the number sentence $\triangle + \triangle = 16$ true?
   1) 2
   2) 4
   3) 6
   4) 8

5. In the numeral 5764, what digit is second from the right?
   1) 5
   2) 7
   3) 6
   4) 4

6. What should replace the □ in $3 + 4 \square 7$?
   1) =
   2) <
   3) >
   4) ≠

7. Which picture below best shows that $1 + 3 = 4$?



Go on to next page

8. What whole number is greater than 2 and less than 4?

1) 1 3) 5
2) 3 4) 8

9. How would you write 200 + 30 + 4 as a 3-digit numeral?

1) 900 3) 324
2) 504 4) 234

10. Jane had 5 dolls and gave 2 to her little sister. Which number sentence below can you use to find how many dolls Jane has left?

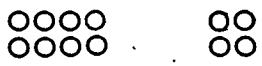
1) $5+2=n$ 3) $5-2=n$
2) $2+5=n$ 4) $2-5=n$

11. Which numeral below tells how many eggs are in an empty egg carton?

1) 12 3) 1
2) 6 4) 0

12. Which picture below best shows that one-half of twelve is six?

1) 

2) 

3) 

4) 

13. Karen's little brother is 3 feet tall. How many inches tall is he?

1) 9 3) 30
2) 24 4) 36

14. What is the missing numeral in the number sentence $12 - n = 7$?

1) 3 3) 7
2) 5 4) 19

15. On a clock, what numeral does the minute hand point to at fifteen minutes after nine?

1) 3 3) 9
2) 6 4) 12

4

16. How would you read 2005?

1) Two hundred five
2) Two thousand five
3) Twenty thousand five
4) Two hundred thousand five

17. Which of these is a correct way to write nine dollars and thirty cents?

1) 9.30¢ 3) $930
2) $9.30 4) 9.30

18. What is the missing factor in the number sentence $\square \times 2 = 6$?

1) 3 3) 8
2) 4 4) 12

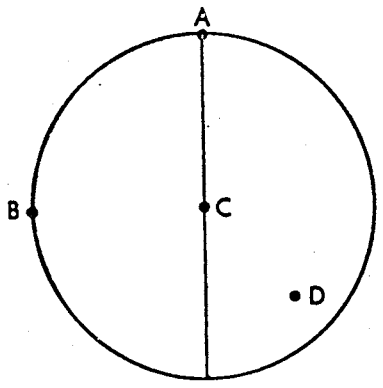
19. In which of these subtraction exercises do you rename a ten as 10 ones or borrow a ten?

1) $\begin{array}{r} 76 \\ -55 \\ \hline 21 \end{array}$ 3) $\begin{array}{r} 96 \\ -63 \\ \hline 33 \end{array}$

2) $\begin{array}{r} 38 \\ -24 \\ \hline 14 \end{array}$ 4) $\begin{array}{r} 43 \\ -26 \\ \hline 17 \end{array}$

20. Which point is the center of the circle shown below?

1) A
2) B
3) C
4) D



21. Ann must practice her piano lesson for 1 hour. If she has already practiced for 45 minutes, how many more minutes must she practice?

1) 5 3) 30
2) 15 4) 55

22. Alice bought an eraser which cost ten cents and paid for it with a quarter. How much change should she get back?

1) 5 cents 3) 15 cents
2) 10 cents 4) 20 cents

Go on to next page

23. Al needs 9 cents to buy a pencil. He has 5 cents. Which number sentence could he use to find how much more money he needs?

1) $9 + 5 = \square$
2) $5 + 9 = \square$
3) $5 + \square = 9$
4) $\square - 5 = 9$

24. Which numeral below is equivalent to 3 ones + 5 tens + 8 thousands?

1) 358
2) 853
3) 8051
4) 8053

25. Ralph is going to visit his brother one week after the last day of school. If the last day of school is June 7, on what date is he visiting his brother?

1) June 12
2) June 14
3) June 15
4) June 17

26. What should replace the $\square$ in the number sentence $9 + 7 = 9 + (4 + \square)$?

1) 3
2) 4
3) 5
4) 7

27. If the sum of two numbers is 12 and one addend is 4, what is the other addend?

1) 3
2) 6
3) 8
4) 16

28. Which number sentence below means the same thing as $(3 + 2) + 4 = n$?

1) $3 + (2 + 4) = n$
2) $(3 - 2) + 4 = n$
3) $(3 + 2) - 4 = n$
4) $3 - (2 + 4) = n$

29. How many thousands are in 10 hundreds?

1) 1
2) 2
3) 10
4) 100

30. Which number sentence below is *false*?

1) $4 > 3$
2) $3 < 7$
3) $6 = 4 + 2$
4) $5 < 1$

GRADE 3
STOP HERE

31. Which numeral below represents a whole number?

1) $\frac{1}{2}$
2) $\frac{1}{10}$
3) $2\frac{3}{4}$
4) 13

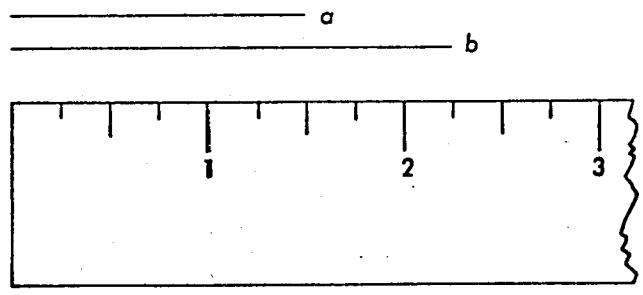
32. In which of these numerals does the digit 2 represent the least value?

1) 3652
2) 7821
3) 3268
4) 2346

33. Which of these is a multiple of 4?

1) 14
2) 22
3) 32
4) 62

34. In the picture below how many inches longer is line segment *b* than line segment *a*?



1) $\frac{1}{2}$
2) $\frac{3}{4}$
3) 1
4) $1\frac{1}{2}$

35. Paul needs \$1.85 to buy a baseball. He has saved 95¢ and his father gave him 50¢. What operations could be used to find how much more money he needs?

1) Addition, multiplication
2) Multiplication, division
3) Addition, division
4) Addition, subtraction

36. Ed bought four 8-ounce sacks of peanuts. How many pounds of peanuts did he buy?

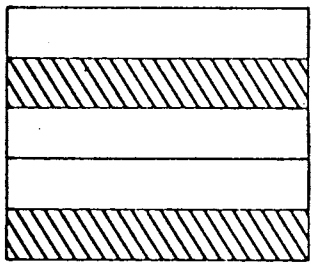
1) 1
2) 2
3) 4
4) 16

Go on to next page

37. The number 56 is divisible (without remainder) by what number?

1) 3
2) 5
3) 7
4) 9

38. What part of this figure is shaded?



1) $\frac{1}{3}$
2) $\frac{2}{5}$
3) $\frac{3}{5}$
4) $\frac{2}{3}$

39. What is the greatest number of 5¢ stamps Sue can buy for 29¢?

1) 4
2) 5
3) 6
4) 7

40. What number is 100 greater than 2937?

1) 2938
2) 2947
3) 3037
4) 3937

41. Which operator below, used in place of the △, will make $12 \triangle 4 = 3$ true?

1) $+$
2) $-$
3) $\times$
4) $\div$

42. What is a short method of writing the number sentence $7+3+3+3+3=\square$?

1) $7+(4\times 3)=\square$
2) $3+(7\times 4)=\square$
3) $(7+3)\times 4=\square$
4) $(4+3)\times 7=\square$

43. Which statement below is *false*?

1) A quarter is $\frac{1}{4}$ of a dollar.
2) A dime is $\frac{1}{10}$ of a dollar.
3) A nickel is $\frac{1}{5}$ of a dollar.
4) A penny is $\frac{1}{100}$ of a dollar.

44. Which statement below is true about the number sentence $\square \times 4 = 636$?

1) The missing factor is equal to 100.
2) The missing factor is equal to 109.
3) The missing factor is less than 100.
4) The missing factor is greater than 100.

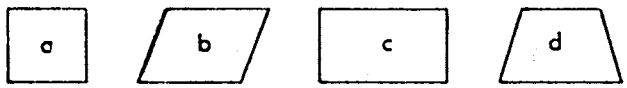
45. Which of the following is equivalent to 32×4?

1) $32+4$
2) $32\div 4$
3) $4\times(3+2)$
4) 4×32

46. Which numeral below is equivalent to 1?

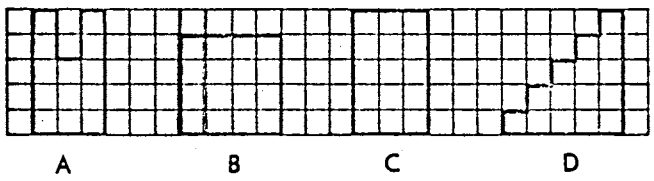
1) $\frac{6}{6}$
2) $\frac{6}{1}$
3) $\frac{1}{6}$
4) $\frac{3}{6}$

47. Which figure below is *not* a parallelogram?



1) a
2) b
3) c
4) d

48. Which shaded figure below has the greatest area?



1) A
2) B
3) C
4) D

49. Which number sentence below is *false*?

1) 5 tens 6 ones = 6 tens 5 ones
2) 3 tens 14 ones = 4 tens 4 ones
3) $40+7=30+17$
4) $50+0=40+10$

50. Which of the following is *not* equivalent to 8×9?

1) 7×10
2) 6×12
3) 9×8
4) 2×36

51. A new operator ∘ between two numerals means triple the first number and subtract the second number. What does $3 \circ 1$ equal?

1) 0
2) 4
3) 8
4) 10

Self-Esteem Inventory (SEI)

Coopersmith

Please mark each statement in the following way:

If the statement describes how you usually feel, put a check ( ) in the column, "Like me."

If the statement does not describe how you usually feel, put a check ( ) in the column "Not Like Me."

There are no right or wrong answers.

		Like Me	Not Like Me
1.	I spend a lot of time daydreaming.	_____	_____
2.	I'm pretty sure of myself.	_____	_____
3.	I often wish I were someone else.	_____	_____
4.	I'm easy to like.	_____	_____
5.	My parents and I have a lot of fun together.	_____	_____
6.	I never worry about anything.	_____	_____
7.	I find it very hard to talk in front of the class.	_____	_____
8.	I wish I were younger.	_____	_____
9.	There are lots of things about myself I'd change if I could.	_____	_____
10.	I can make up my mind without too much trouble.	_____	_____
11.	I'm a lot of fun to be with.	_____	_____
12.	I get upset easily at home.	_____	_____
13.	I always do the right thing.	_____	_____
14.	I'm proud of my school work.	_____	_____

		Like Me	Not Like Me
15.	Someone always has to tell me what to do.	_____	_____
16.	It takes me a long time to get used to anything new.	_____	_____
17.	I'm often sorry for the things I do.	_____	_____
18.	I'm popular with kids my own age.	_____	_____
19.	My parents usually consider my feelings.	_____	_____
20.	I'm never unhappy.	_____	_____
21.	I'm doing the best work that I can.	_____	_____
22.	I give in very easily.	_____	_____
23.	I can usually take care of myself.	_____	_____
24.	I'm pretty happy.	_____	_____
25.	I would rather play with children younger than me.	_____	_____
26.	My parents expect too much of me.	_____	_____
27.	I like everyone I know.	_____	_____
28.	I like to be called on in class.	_____	_____
29.	I understand myself.	_____	_____
30.	It's pretty tough to be me.	_____	_____
31.	Things are all mixed up in my life.	_____	_____
32.	Kids usually follow my ideas.	_____	_____

		Like Me	Not Like Me
33.	No one pays much attention to me at home.	_____	_____
34.	I never get scolded.	_____	_____
35.	I'm not doing as well in school as I'd like to.	_____	_____
36.	I can make up my mind and stick to it.	_____	_____
37.	I really don't like being a boy-------firl.	_____	_____
38.	I have a low opinion of myself.	_____	_____
39.	I don't like to be with other people.	_____	_____
40.	There are many times when I'd like to leave home.	_____	_____
41.	I'm never shy.	_____	_____
42.	I often feel upset in school.	_____	_____
43.	I often feel ashamed of myself.	_____	_____
44.	I'm not as nice looking as most people.	_____	_____
45.	If I have something to say, I usually say it.	_____	_____
46.	Kids pick on me very often.	_____	_____
47.	My parents understand me.	_____	_____
48.	I always tell the truth.	_____	_____
49.	My teacher makes me feel I'm not good enough.	_____	_____
50.	I don't care what happens to me.	_____	_____

		Like Me	Not Like Me
51.	I'm a failure.	_____	_____
52.	I get upset easily when I'm scolded.	_____	_____
53.	Most people are better liked than I am.	_____	_____
54.	I usually feel as if my parents are pushing me.	_____	_____
55.	I always know what to say to people.	_____	_____
56.	I often get discouraged in school.	_____	_____
57.	Things usually don't bother me.	_____	_____
58.	I can't be depended on.	_____	_____

Smith, Cooper. The Antecedents of Self Esteem. San Francisco, W.H. Freeman Co. 1967.

SELF CONCEPT INSTRUMENT
A LEARNER SCALE
(To Be Used 1971-72)

Developed by Walter B. Waetjen, University of Maryland
Modified for Elementary School Children
by Gordon P. Liddle, University of Kentucky

Read the following statements. If you agree with them or think they are true of you circle, yes. If you disagree or think they are not true of you circle, No.

Name_____

1.	**Yes**	No	I usually like to go to school.
2.	**Yes**	No	I usually ask the teacher to explain something again if I don't understand.
3.	Yes	**No**	When school work is hard, I usually give up.
4.	**Yes**	No	I try to change when I know I'm doing things wrong.
5.	**Yes**	No	Doing well in my school work is important to me.
6.	**Yes**	No	I do my school work without being told more than once.
7.	**Yes**	No	I like to start work on new things.
8.	Yes	**No**	I often forget what the teacher told us to do next.
9.	**Yes**	No	It is easy for me to stand up in front of the class and tell them something.
10.	Yes	**No**	I often do things without thinking.
11.	**Yes**	No	I get my work done on time.
12.	Yes	**No**	I sometimes copy from my friends.
13.	Yes	**No**	Fairly often I give up because I don't understand something.
14.	Yes	**No**	I often make mistakes because I did not listen carefully.
15.	**Yes**	No	I try to be careful about my work.
16.	Yes	**No**	I get scared when I'm called on in class.
17.	Yes	**No**	I find it hard to remember things.
18.	**Yes**	No	I usually understand a story the first time I read it.
19.	**Yes**	No	I do well on tests.
20.	**Yes**	No	I feel good about my school work.
21.	Yes	**No**	Often I don't understand what is going on in class.
22.	Yes	**No**	I have trouble learning.
23.	**Yes**	No	I solve problems quite easily.
24.	Yes	**No**	Most kids are smarter than I am.
25.	**Yes**	No	I often know the answer before the rest of the class.
26.	**Yes**	No	I can figure things out for myself.
27.	**Yes**	No	I get good grades easily.
28.	**Yes**	No	I find it easy to get along with my classmates.
29.	**Yes**	No	I like the kids in this class very much.
30.	**Yes**	No	I try to play fair with my classmates.
31.	**Yes**	No	I am an important person to my classmates.
32.	**Yes**	No	My classmates like me.
33.	**Yes**	No	Most of my best friends are in this class.
34.	Yes	**No**	I find it hard to talk to classmates.
35.	Yes	**No**	I feel left out of things in class.
36.	**Yes**	No	My classmates miss me when I'm absent from school.

6/30/67 The desirable answers are underscored for use as a scoring key.

ARITHMETIC ATTITUDE SCALE
1970-71

1. I feel arithmetic is an important subject.

2. Arithmetic is something you have to do even though it is not fun.

3. Working with numbers is fun.

4. I have never liked arithmetic.

5. Arithmetic turns me on and I like it better than any other subject.

6. I do not feel good when I study arithmetic.

7. I like arithmetic because it makes sense.

8. I am afraid of doing word problems.

9. I like working all kinds of arithmetic problems.

10. I hate arithmetic and try to get out of doing it.

11. I am beginning to see why I need to know about arithmetic

12. I could care less about arithmetic.

13. I have always liked arithmetic because it makes me think and I like to think.

14. I like arithmetic but I like other subjects just as well.

15. Finishing a problem and finding out it is right makes me feel good.

Name_____

Teacher_____

MATHEMATICS ATTITUDE SCALE

Directions: Put a circle around the item at the right which tells how YOU feel about the statement:

1.	I feel mathematics is an important subject.	"Like Me"	"Not Like Me"	"Can't Decide"
2.	Mathematics is something you have to do even though it is not fun.	"Like Me"	"Not Like Me"	"Can't Decide"
3.	Working with numbers is fun.	"Like Me"	"Not Like Me"	"Can't Decide"
4.	I have never liked mathematics.	"Like Me"	"Not Like Me"	"Can't Decide"
5.	Mathematics turns me on and I like it better than any other subject.	"Like Me"	"Not Like Me"	"Can't Decide"
6.	I do not feel good when I study mathematics.	"Like Me"	"Not Like Me"	"Can't Decide"
7.	I like mathematics because it makes sense.	"Like Me"	"Not Like Me"	"Can't Decide"
8.	I am afraid of doing word problems.	"Like Me"	"Not Like Me"	"Can't Decide"
9.	I like working all kinds of mathematics problems.	"Like Me"	"Not Like Me'	"Can't Decide"
10.	I hate mathematics and I try to get out of doing it.	"Like Me"	"Not Like Me"	"Can't Decide"
11.	I am beginning to see why I need to know about mathematics.	"Like Me"	"Not Like Me"	"Can't Decide"
12.	I could care less about mathematics.	"Like Me"	"Not Like Me"	"Can't Decide"
13.	I have always liked mathematics because it makes me think and I like to think.	"Like Me"	"Not Like Me"	"Can't Decide"

14. I like mathematics but I like other subjects just as well "Like Me" "Not Like Me" "Can't Decide"

15. Finishing a problem and finding out it is right makes me feel good. "Like Me" "Not Like Me" "Can't Decide"

A P P E N D I X C

CLASSROOM PROCEDURES FROM NATIONAL SEED PROJECT

a. CLASS INVOLVEMENT AND FEEDBACK TECHNIQUES

b. PUPIL SUPPORTIVE TECHNIQUES

c. TOPIC DEVELOPMENT TECHNIQUES

CLASSROOM PROCEDURES FROM NATIONAL SEED PROJECT

CLASS INVOLVEMENT AND FEEDBACK TECHNIQUES

1. Fingers - Have the class show the answers on their fingers. If the answer is big, let two rows cooperate on indicating the answer. Have the students close their eyes before showing. Number answers, let pupils show which answer they agree with.

2. Arm signals - introduce signals for "I agree", "I disagree", "I don't know", "It can't be done". These signals allow the students to all show you what they think about what is being discussed with out noisily interrupting the speaker. Encourage use of agree-disagree after anyone has spoken.

3. Circulate - Give the class a problem to do on their papers, have someone read the problem while everyone copies it, then quickly check their work. Stopping to help a slower student will call attention to his having trouble. Notice which non-responders are getting some or all of the problem right and call on them with confidence that they will have a success experience.

4. Chorus reading - Have the class read a symbol, sentence, or vocabulary word together. It changes the pace, allows everyone a chance to speak, focusses in on the boardwork.

5. Deliberate mistakes - Make mistakes to keep them alert, praise the students who catch mistakes.

6. Rapid oral questions - a series of questions which will help focus their attention, and establish a faster pacing.

7. Counting, naming, predicting the hands which are up - will encourage more children to get involved. "Only ten hands?", "Sylvia has her hand up" "This is a 12 hand question, this is a no-hand question".

8. Chain answers - To involve many students on one problem, allow a student to say only one word of the answer, he calls on the next child to continue the answer.

9. Questions on their state of being - Are you ready? Are you sure? Can you see this? How many will remember tomorrow? How many got that answer? Questions directed to the whole class.

10. Erase and rapid review - erase the board supposedly for more board space, then ask the class to reconstruct the material again rapidly.

INVOLVEMENT AND FEEDBACK TECHNIQUES (cont.)

11. Students to the board.

12. Silent riot - let every student "riot" with the condition that they may not make any noise; They can wave their arms in agreement or disagreement.

PUPIL SUPPORTIVE TECHNIQUES

1. Use students names - when calling on them, to recognize their hands are up, as a way of referring to ideas, such as: Johnny's Hypothesis

2. Students call on other students - when a student is having difficulty or doesn't know the answer, let him call someone to help; "while he is thinking. . ." gets him off the spot

3. Pre-teach - take slower moving students a-side outside of class and teach them something that you will be presenting to the class later, when you come to it he will star in it

4. Explore the consequences of off-beat answers - draw out the reasoning behind "wrong" answers, the class gains a richer experience, the student does not feel put down. Be willing to explore systems the students suggest.

5. "Who has it now who didn't have it before?" - Give students a chance to indicate having learned something even though they may not have done the problem correctly, (after an explanation of a problem)

6. "Can you say anything about it?" - When you call on a student who feels he doesn't know the answer, encourage him to try to make some contribution towards figuring it out; if he can do any PART of the problem he has the start of a success experience.

7. Student repeat answer another gave - Call on a non-responder to repeat someone else's answer to get him involved and focusing on the problems. Let several students tell you their answers, even if someone else has already said that answer.

8. Erasing clues - make an elaborate show of erasing any clues or hints on the board, telling the children you don't want to give away the answer. Your intention, of course, is exactly the opposite.

9. Allow revisions - when the class indicates disagreement with a student's response, allow him to look again at what he is saying and revise it if he wants to before calling on another student to see why he is disagreeing.

10. Whisper your answer to your neighbor - often a shy student will not respond out loud but will tell his neighbor what he is thinking, have the neighbor tell the class. The reverse also works, have a neighbor whisper his answer to a shy student, have the shy student show agreement or disagreement.

TOPIC DEVELOPMENT TECHNIQUES
MATHEMATICS

1. Review (see attached)

2. Gradual escalation to generalizations - introduce variables by substitution into a true sentence where they see that anything works the same way. Stop the eraser when we need to change something.

3. Intermediate steps - write down the thinking steps that show how to get the answer.

4. Preceding problems - Use previous problems to help shorten the work of calculating answers, and to help explain what is going on

5. "Write a true mathematical sentence containing" - an unknown expression, which you are interested in evaluating.

6. What is it acting like? - to define terms or expressions once they are contained in a true sentence.

7. Break up, expand, shorten and rewrite - changing the names of a term to help solve a problem containing it. Use vertical arrows and rewrite the entire sentence to show clearly where all the equivalent expressions are coming from.

8. Leave work on board - plan your boardwork so that you can leave as much of a lesson on the board as possible so the children can refer back to previous examples, and so they can see all the work they have accomplished that lesson.

9. Number the problems - to make it easier to refer to them and to keep track of which problem you are working on.

10. Children make up problems - This activity involves every student, provides some feedback about how they see what they have been studying, and stimulates some very interesting problems to come naturally from the class.

11. Box a question or important sentence for the next day, give a "Last Problem" and leave the class on a high note.

12. Erase everything but the generalization - let the students decide what should be erased and what should be left, they will start organizing the material better.

13. "Who can ask the next question?" - let the students try to predict what you are going to ask about a problem, it sharpens their ability to draw implications and conclusions.

14. Set up the FORM of the answer - prevents too much wild answers.

A P P E N D I X D

P U B L I C I T Y

a. THE BULLETIN - MINNEAPOLIS PUBLIC SCHOOLS

b. MINNEAPOLIS TRIBUNE - PICTURE MAGAZINE

c. SPOKESMAN

the bulletin

MINNEAPOLIS PUBLIC SCHOOLS

Special School District No. 1, Minneapolis, Minn. | April 23, 1971 | Vol. 57,No. 33

Willard Students Race Through SEED Math

The terminology indicated a college math course; this idea was confirmed by the University professor in tweeds who stood at the blackboard. He asked questions – accepted answers and made quips as his hand flew continually across the board. They discussed formulas, negatives, and minus factors. This was not a college class or even a group of quiz kids, but rather a fourth grade at Willard Elementary School.

Fifth and sixth graders at Willard have been working routinely all year with advanced mathematics and according to their teachers are "clearly understanding what they are doing – and loving every minute of it." They state that children who were having difficulty learning the simplest math facts are now racing through advanced math as part of a new and exciting project. This project is termed SEED, SEED being an acronym for Special Elementary Education for the Disadvantaged.

Every day from 8:45 to 9:20 four Institute of Technology professors from the U of M's Math department are involving Willard students in abstract math.

Says Willard's principal, Herbert Karsten, "Project SEED has done a tremendous job in building self-image. Kids have been bubbling about school and we have been getting calls from parents asking what is making them so enthusiastic. Since the program has been so successful in the upper grades, we have decided to begin trying it in third and fourth grades and we expect to find the same results in these classes."

The father of this invention is Dr. William Johntz, a former high school teacher from Berkeley, California, who, like many others, was concerned about teaching ghetto kids. Dr. Johntz began testing out his ideas during his lunch hour by teaching algebra to classes of Black elementary school students. He claimed it an instant success.

Dr. Johntz states that abstract mathematics is one of the few topics in which children from all backgrounds start out on even terms and virtually from scratch. "Many disadvantaged children entering the first grade," he said,"have spent six years listening to 'bad English' spoken in their homes and neighborhoods. They have not, however, been subjected to six years of 'bad math.' No math, perhaps, but not 'bad math.'"

Because of Dr. Johntz and his efforts, SEED claims to have this college preparatory math program operating successfully in more than 400 elementary classrooms across the country.

Newsweek calls Project SEED "professional in its approach," while the September-October issue of *Think*, the IBM house magazine, claims it "nothing less then sensational" – and the Willard students? They were too busy doing it to be quoted.

By Brian Anderson
Staff Writer

Can a linear equation find happiness in an inner-city elementary school?

Is there a place in a fourth-grade classroom for formula-touting professors?

Can the ivory tower of the University of Minnesota fit inside a North Side elementary school without crumbling from exposure to the "real world?"

The answers are "yes, yes, yes," and Willard School and four university professors are proving the point.

Four times a week the professors, three from the university's Institute of Technology and one from the College of Education's math division, pack up their slide rules and head for Willard, 16th and Queen Avs. N., where they each teach a one-hour algebra class.

In a setting more appropriate for Dick and Jane than Euclid and Pythagoras, the professors talk about logarithms, linear equations, exponentiation and ordered pairs. And the kids eat it up.

"What is log base 2 of 4?" Leonard Shapiro, assistant professor in IT, asked his fifth graders during a recent class. "Two," they replied in loud chorus.

"Let's say that 2 times box plus 1 equals triangle," said Tom Post, the associate of education, as he wrote the equation on the board. "If the box is negative 3, what is the second number of the ordered pair?" Within minutes most of the fifth graders had the answer.

The program which brings the professors (and one College of Education graduate student, who also teaches a class) into Willard is known as Project Seed. Part of the federally-funded Training of Teacher Trainers (TTT) project, the program is a supplement to the regular arithmetic instruction which all students continue to receive.

The Willard program is adapted from a math education concept conceived by William Johntz, a teacher in Berkeley, Calif. That concept recognizes math as a "culture-free" discipline which doesn't depend upon previous learning or background to be learned.

The mathematical concepts taught "are every bit as complex as those we deal with in the university," according to Shapiro. "Actually, it's easier for elementary kids to deal with abstract mathematics than it is for adults," added Gene Fabes, an as-

sociate professor of math who teaches a fourth grade class at Willard and a "Partial Differential and Integral Equations of Applied Math" course at the university. "The longer the students are in school, the more fixed their ideas become," he added.

The professors are trained to use the "discovery" approach in teaching, which means that a student is never told his answer is wrong. Instead, students are asked to explain how they got their answers. The logic and procedures they employ are what's important.

According to Post, the idea isn't so much to teach algebra as it is to use algebra to improve the students self-esteem and get them thinking about intellectual concepts.

"I can remember two times in my four years of high school when I did something better than anyone else in the class," Shapiro said. "That's what we're trying to achieve here, to give kids something which they'll remember doing well in."

Some of the regular teachers at Willard have observed optimistic results.

"I have one boy who got very upset whenever he did something wrong," said Mrs. Joan Mills, fourth grade teacher. "It got so that he wouldn't even try. But when Gene (Fabes) came, the boy gave answers and they weren't wrong. In the "discovery" method, every answer is feasible. Now he tries where he never did before."

A girl in another class was withdrawing more and more as her classmates teased her about being overweight. But the girl became "smart" in algebra, "and now she feels she's not as bad as she thought," according to Barbara Held, fifth grade teacher. "She is more willing to contribute now in social studies, science and other areas," she added. "And in algebra she thinks she's the hottest thing since sliced bread."

The professors will be the first to admit, though, that the program is no miracle approach to education. There are days when they grind their teeth and silently count to ten (and that's not part of the lesson, either). But then there are also those days when Dennis proudly discovers that logarithms are "just the backwards of powers," and Linda wonders aloud why negative zero can't be called "just plain zero."

For men steeped in academia and its lecture approach to education, the elementary classroom can be a frightening experience.

"I'm more nervous walking into that fifth grade classroom than I am walking into a class of doctoral candidates," Shapiro said.

Fabes said his worst classes have been those in which he tried to lecture. "The kids want to participate in the class," he said. "It's not like the university where the students absorb facts. Here they discover them. You get a lot more student response here than from university classes. When the students get bored here they tell you. At the university it's difficult to incite any kind of response."

Some of the professors tried implementing the "discovery" method in their university classes, but were without much success.

Hillel Gershenson, an associate professor of math who teaches a sixth grade section, said he cut down on the amount of lecturing he does and was criticized by the students for not "telling" them enough.

Shapiro asked his freshman calculus class to work out a problem and the result was near-chaos.

"I stepped off the podium into the class. Books dropped off desks, pencils rolled down the aisles and it was a frightening thing," he said. "Kids were saying, 'What's he doing? It's against the rules.' "

Except for Post, who taught school earlier in his career, this was the first time the professors had spent any amount of time in elementary school since those days of yore when they, too, pulled pigtails and shot squirtguns when they were supposed to be writing their ABC's.

Before they started teaching, the men went through a short training program, which primarily emphasized the "discovery" method. But for the most part it has been a learning-by-doing experience. The professors claim to have had immeasurable help from the regular classroom teachers, who observe each session and then discuss it with the professors.

"I've learned teaching methods just by watching Gene," Mrs. Mills said of Fabes. "When a student is on to a mathematical concept, he's able to bring it out of the student. It's the type of thing it would be difficult for the regular teacher without special math training to do."

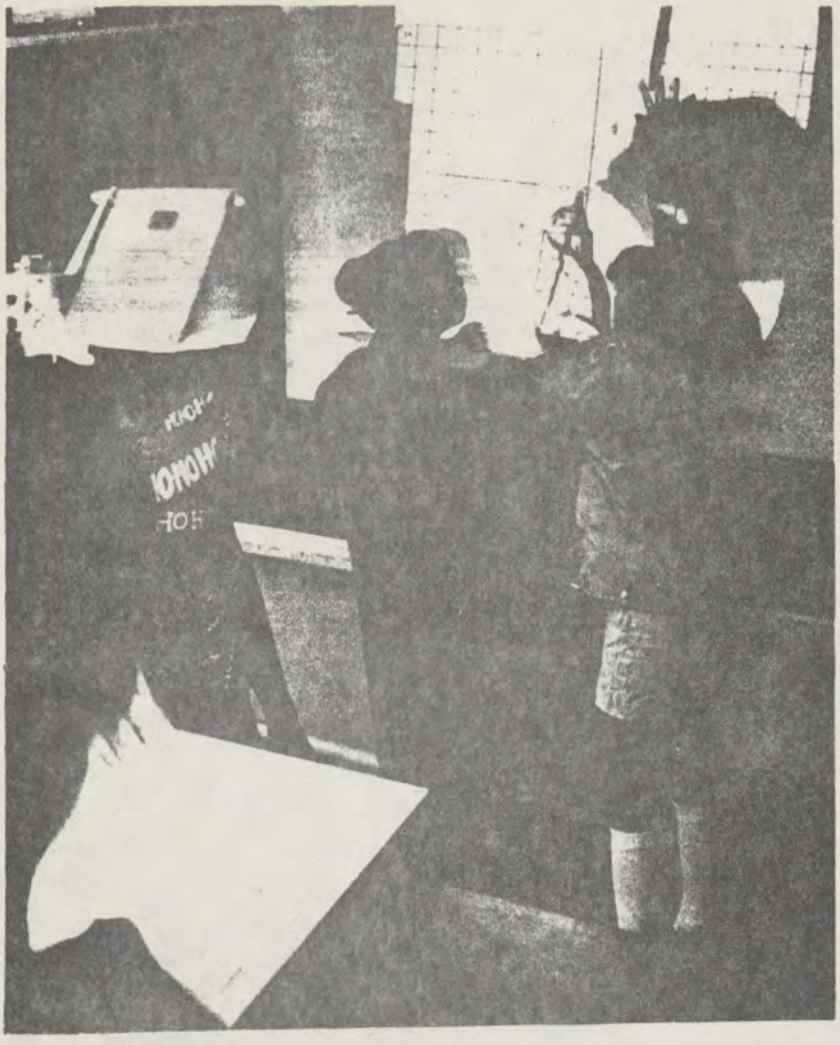
One of the problems which all the professors had to face was discipline. Some of them had, as Gershenson described it, "the classic liberal hangup—complete permissiveness."

Shapiro concurred. "It's really hard that first time to violate your principles and say 'shut up,'" he said. "One day the noise really got to me, though, and I yelled. They were quiet for two weeks after that," he said.

Despite the occasional noise and turmoil of the elementary classroom, the professors have found the spontaneity and enthusiasm of their Willard students a welcome addition to their working day.

"We have good days and bad days here," Shapiro said. "But at the university you never have a good class or a bad class. There it's always just an 'okay' class."▷

Many pictures accompanied this article. A few of which are included below.



Fifth and sixth grade students plotting simultaneous linear equations.

A flurry of raised hands in a fifth grade class follows a question by Leonard Shapiro.

David Smith, a fourth grader at Willard, discusses a math problem with Gene Fabes.

Page 6, Minneapolis SPOKESMAN, Thursday, May 27, 1971

Federally Aided SEED Challenges Six Year Olds In Math

Thumb-sucking six-year-olds listened intently to college professor Dr. Leonard Shapiro as they explore number concepts together. Hands waved eagerly to get the attention that an answer—right or wrong—migh bring.

The level of excitement rose as "Mister Shapiro" became involved on a one-to-one basis with young sters as he posed a question, then alternately encouraged the children to call out the answer or confide i to him in a whisper.

The scene was Phyllis Brooks' first grade transition classroom in North Minneapolis' Willard Element ary School last week, where a special mathematics enrichment project called SEED has brought three University of Minnesota professors to inner-city classrooms throughout most of the past year, to teach modern math concepts and explore algebra with children in elementary grades.

SEED is being explored with urban children in several pilot programs in different parts of the United States, in an attempt to tap the potential of children who, although they may lack interest in language - related activities, may enjoy the precision of mathematics. At the same time, the children usually feel flattered at the idea of stretching to subject matter traditionally left to secondary schools and colleges.

Others involved at Willard are Professors Gershenson and Post of the University's mathematics department. Willard's program is coordinated by Glen Enos of the federally-funded TTT (Training of Teacher Trainers) project, designed to seek better teaching methods and train prospective teachers in their use.—Photo by Ann Desmond.

A P P E N D I X E

R A W D A T A

a. EXPERIMENTAL THIRD GRADE

b. EXPERIMENTAL FOURTH GRADE

c. CONTROL THIRD GRADE

d. CONTROL FOURTH GRADE

EXPERIMENTAL THIRD GRADE (CELL 1)

TEACHER EXPECTATIONS

NAME		IOWA		SELF ESTEEM		ATTITUDE		READING		LANGUAGE ARTS		SOCIAL STUDIES		ARITHMETIC		ART		PEERS	
		PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST
JOHN	231150	9	7	60	64	- 4	0	2	4	4	4	4	5	3	4	8	7	0	2
PRESTON	231151	11	19	84	46	+ 5	+ 7	6	7	4	6	6	6	6	6	9	9	8	6
DAWN	232152	12	13	76	54	+ 2	+ 9	7	6	6	6	5	7	7	6	7	7	9	4
APRIL	232153	9	20	70	62	+ 9	+ 2	8	8	7	8	7	8	8	7	8	8	5	4
BENNY	231154	5	15	73	46	+ 7	+ 6	8	8	8	8	8	8	8	8	6	7	8	5
ROSITA	232155	16	5	62	54	+11	- 5	1	2	2	2	2	3	1	2	3	5	2	0
JUDI	232156	16		50	48	- 2	+ 5	7	7	7	7	6	7	7	6	6	6	0	0
DENNIS	231157	14	16	56	56	- 4	- 6	7	6	6	7	5	7	7	7	9	9	2	2
MICHAEL	231158	17	20	77	66	+ 3	+11	8	8	8	8	7	8	8	9	7	8	5	3
DEREK	231159	16	15	86	78	+ 9	- 2	9	9	8	8	8	9	9	9	6	8	3	2
FAITH	232160	20	27	80	86	- 3	+ 5	8	9	8	9	7	9	8	9	7	8	3	5
ALICE	232161	16	2		68	+ 7	- 5	3	3	3	3	3	3	2	3	6	7	1	3
JAMES	231162	9	2	70	66	+ 5	+ 1	5	3	3	4	4	3	5	3	9	9	4	2
WANDA	232163	14	18	70	70	- 4	- 3	8	7	8	8	7	8	8	8	8	8	0	0
DIANE	232164	11	10	54	64	+ 8	+ 9	7	6	7	7	7	7	7	7	7	7	9	7
KENNY	231165	16	15	62	66	+ 1	4	6	4	6	6	6	6	6	7	4	7	1	0
DEBORAH	232166	13	10	66	5C	+ 3	+ 5	4	3	4	3	4	4	4	3	5	6	1	3
SCOTT	231167	18	24	76	64	0	+ 4	6	6	6	6	6	6	6	6	4	5	2	1
TONY	231168	6	8	54	68	- 1	+ 5	7	7	6	8	7	8	8	8	3	6	1	2
MARK	231169	17	19	46	60	- 5	- 4	7	7	6	7	7	8	7	8	6	5	0	0
KERRY	232170	7		58		+ 8	- 3	7	6	5	6	6	7	7	7	5	6	7	9
PAULA	232171	12	10	81	52	+ 6	+ 7	6	5	5	6	7	6	6	6	7		0	0
STEVEN	231172	(	OMIT	-	No	Data		+ 4											
STEPHANIE	232173	(	No Cards					- 1											
		+56	-42	+52	-185			137	131	127	137	129	143	138	139	140	148		

EXPERIMENTAL FOURTH GRADE (CELL 2)

TEACHER EXPECTATIONS

NAME		IOWA MATH RS / %		SELF ESTEEM INVENTORY		ARITHMETIC ATTITUDE		READING		LANGUAGE ARTS		SOCIAL STUDIES		ARITHMETIC		ART		SCIENCE	
		PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST
JAMES A.	241050	14/	14/	80	70	- 6	- 8	9	9	8	7	9	6	8	9	6	8	9	8
GARY	241051	9/		74	66	+ 3	+11	4	5	6	7	6	6	8	6	9	8	8	8
HOWARD	241052	11/	22/	50	58	-10	- 4	6	7	6	10	8	6	8	6	6	8	8	8
SCOTT F.	241053	12/	20/	84	100	+ 4	+ 3	6	7	6	5	6	5	8	7	6	6	6	8
SCOTT H.	241054	5/	10/	60	52	-13	- 7	6	5	5	3	6	4	8	6	5	6	6	5
ROBERT	241055	2/	4/	38	28	- 3	- 7	6	7	5	3	3	4	3	5	3	6	4	5
TROY	241056	9/	15/	58	46	+ 9	- 5	7	7	6	5	7	6	8	6	8	6	8	5
JAMES M.	241057	4/	11/	56	64	- 1	- 3	5	5	5	5	5	6	8	6	6	6	6	5
JOE	241058	11/	9/	54	68	- 3	- 7	5	5	4	5	5	5	6	5	6	6	4	5
TODD	241059	5/	12/	56	72	+ 9	+ 6	6	7	7	5	6	6	7	6	6	7	6	7
SERGIO	241060	7/	15/	50	58	+ 9	+ 7	6	7	6	8	6	6	8	6	6	6	5	7
RODNEY	241061	14/	18/	68	72	- 2	- 1	9	9	10	8	8	8	8	8	6	6	9	7
DAVID S.	241062	14/	15/	74	88	+ 5	+ 5	9	8	9	6	8	8	8	6	6	6	9	9
DAVID M.	241063	8/	15/	40	36	+ 8	+ 4	5	5	6	6	6	6	6	6	7	8	5	7
MERILEE	242064	7/		66	90	+ 5	+11	6	6	6	6	6	6	6	6	7	8	5	7
RITA	242065	15/	15/	74	88	- 6	+ 3	9	9	9	5	6	5	8	7	5	6	8	5
CHERI	242066	10/	3/	82	38	+ 4	- 6	6	6	6	6	6	5	6	6	6	6	5	7
PAT	242067	19/	21/	54	64	- 5	+11	6	7	6	8	6	6	8	7	6	6	5	7
DIXIE	242068	11/	7/	56	58	- 3	- 4	5	5	5	6	6	5	6	6	4	6	4	5
JERRY	242069	10/	9/	78	76	- 1	- 5	6	7	6	6	6	6	8	7	6	6	5	7
SUSAN	242070	9/	9/	72	70	+11	+10	7	7	6	8	6	6	8	7	6	6	5	5
MARGUERITE	242071	11/	7/	60	62	- 3	- 3	6	6	6	6	6	5	8	6	6	6	5	7
JACKIE	242072	1/	14/	68	62	+ 4	+ 8	6	5	5	6	6	5	6	6	6	6	5	5
MARY	242073	16/		68		+10	(Out Insufficient data on card												
DAVID B.	241074		11/				(	6		5		6		6		6		5	

CONTROL THIRD GRADE (CELL 3)

NAME		IOWA		SELF ESTEEM		ATTITUDE		TEACHER EXPECTATIONS											
								READING		LANGUAGE ARTS		SOCIAL STUDIES		ARITHMETIC		ART		PEERS	
		PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST
CHARLES	131100	14	15	66	52	- 3	+ 1	6	7	4	5	4	7	8	5	5	4	0	0
MIKE	131101	7	11	74	54	0	0	4	5	4	5	3	5	1	4	8	9	1	3
EARL	131102	12	8	68	58	+ 1	- 1	8	9	6	7	7	7	8	8	2	5	2	4
ERIC	131103	21	22	94	88	- 9	-11	9	9	9	9	9	9	8	9	8	9	7	4
LARRY	131104	10	17	70	62	- 1	+ 1	4	5	4	6	4	7	6	5	5	8	4	4
DALE	131105	12	7		70	3	+ 3	2	3	2	2	2	5	2	3	7	8	1	3
KEVIN T.	131106	20		66		+14	14	9	9	8	9	8	7	8	9	2	4	5	1
GLENN	131107	16	9	81	64	- 7	+ 3	4	6	4	6	4	7	5	5	8	8	3	5
KEVIN V.	131108	22		64	54	+ 4	+ 2	5	7	5	6	4	7	6	6	8	8	5	0
DARRELL	131109	13	7	59	74	- 5	0	3	4	4	4	3	6	1	4	4	6	2	2
TYRONNE	131110	12	7	50	48	- 6	+ 3	1	3	2	2	2	6	2	2	4	7	3	1
JULIE	132111	26	28	100	86	- 6	+ 5	9	9	9	9	9	9	9	9	8	9	3	3
VIRGINNIA	132112	19	21	42	48	+ 1	+ 3	9	9	9	9	9	9	9	9	6	8	1	0
BONITA	132113	10	11	58	52	+ 1	+ 2	5	6	4	6	4	6	4	6	3	7	2	1
ANGELA	132114	19	19	66	52	- 5	+ 3	9	9	8	9	8	9	8	9	5	8	4	5
RHONDA	132115	20	26	70	82	- 6	+ 9	9	9	9	9	9	9	9	9	6	8	9	10
RUTH	132116	7	8	65	58	+ 5	+ 3	3	3	3	3	2	5	1	2	5	7	0	1
ANNETTE	132117	21	20	60	58	- 5	- 8	9	9	9	9	8	9	8	9	4	5	3	2
TANYA	132118	22	17	70	58	+ 7	- 2	9	9	9	9	9	9	9	9	5	8	4	6
LINDA N.	132119	10	7	62	64	+ 3	+ 1	1	3	2	3	1	4	0	2	6	7	4	1
ANTIONETTE	132120	23	20	84	54	+ 2	+ 2	3	5	3	5	3	6	4	3	5	6	2	5
YVETTE	132121	18	21	48	52	- 5	- 8	9	9	9	9	9	9	9	9	7	9	4	4
MARCIA	132122	17	18	46	66	+ 3	+10	9	9	9	9	9	9	9	9	7	9	4	1
MARY ELLEN	132123	9	12	78	38	+ 3	+ 3	4	5	5	5	4	6	4	6	5	7	2	0
LINDA W.	132124	18	20	70	54	- 5	- 1	4	6	5	6	4	5	4	5	5	8	0	1
		+34	-39	+59	-225			147	167	145	160	138	177	142	156	138	182		

CONTROL FOURTH GRADE (CELL 4)

NAMES	Columns 1-6	Raw Scores above slash / Percentiles below slash IOWA PRE	IOWA MATH POST	SELFESTEEM INVENTORY PRE	SELFESTEEM INVENTORY POST	ARITHMETIC ATTITUDE PRE	ARITHMETIC ATTITUDE POST	TEACHER EXPECTATIONS READING PRE	READING POST	LANGUAGE ARTS PRE	LANGUAGE ARTS POST	SOCIAL STUDIES PRE	SOCIAL STUDIES POST	ARITHMETIC PRE	ARITHMETIC POST	ART PRE	ART POST	SCIENCE PRE	SCIENCE POST
JEROME	141001	10/	5/	76	76	- 7	-12	8	5	8	5	6	6	7	7	8	8	9	6
BERNEST	142002	8/	16/	82	94	+13	+11	8	5	6	6	7	7	8	8	9	6	7	7
DARNELL	142003	5/	11/	76	66	+ 9	+13	5	2	6	6	6	5	8	5	6	8	5	5
CHARLES	141004	7/	20/	76	74	+ 5	+ 3	8	9	8	9	7	8	10	9	8	8	10	8
ALVIN	141005	8/	18/	88	76	+10	+ 3	8	8	8	7	5	7	9	8	8	6	8	8
DANIEL	141006	11/	15/	62	84	+ 9	+ 9	10	9	10	10	10	9	10	10	8	5	9	9
TIM	141007	9/	9/	60	62	+ 1	+ 1	4	2	7	2	5	6	5	2	6	9	5	4
BRENT	141008	26/		92	92	+10	+ 9	10	10	10	9	9	9	10	10	10	6	10	10
TONY	141009	5/	13/	68	64	- 3	+ 1	6	3	6	4	6	5	8	7	9	9	7	5
LOYD	141010	6/	20/	76	60	+ 5	+ 9	6	5	6	6	9	9	4	7	7	8	9	6
JOHN	141011	16/	16/	78	74	+10	+11	9	3	10	8	10	8	10	10	7	6	10	10
FRANK	141012	7/	4/	44	60	+ 1	0	7	8	8	7	9	6	5	2	9	6	9	6
BENJY	142013	25/	32/	90	94	+ 4	+ 9	9	6	10	9	10	8	10	9	8	4	10	10
LONNIE	142014	14/	15/	86	84	+ 5	+ 5	8	5	8	4	7	5	7	6	10	7	7	5
GEORGE H.	141015	7/	16/	66	62	- 6	- 1	6	6	6	2	9	7	6	4	6	4	8	7
GEORGE M.	141016	6/	10/	60	74	+ 7	+ 7	6	3	5	3	7	5	7	6	6	8	7	6
ANITA	142017	4/	6/	76	78	+ 4	+ 2	7	9	7	3	7	6	5	4	10	7	5	5
ROBIN	142018	14/		66	84	+12	14	7	8	5	8	7	8	5	5	7	6	5	7
SHARON	142019	5/		92		+12		5		6		9		8		10		8	
KENA	142020	10/	11/	76	60	+ 3	0	7	3	7	8	6	6	7	7	8	7	5	7
CATHY	142021	7/	11/	70	70	+12	+9	9	6	9	9	8	5	8	6	9	7	8	5
REOLA	142022	13/		54	40	+11	+3	8	8	8	7	9	7	8	6	9	8	9	6
KELLY	142023	12/		78	68	+13	+11	7	8	9	8	8	6	8	8	9	8	8	8
BRENDA	142024	24/	26/	88	62	+14	+ 7	9	10	9	8	9	8	10	10	9	8	10	9
PAT	142025	12/	19/	72	82	+11	- 1	10	10	10	10	7	9	10	10	9	9	10	9
JULIE	142026	6/	13/	68	62	- 1	- 2	8	8	9	7	7	7	6	5	9	8	9	6

NOTE:: Finn Program requires complete data on all variables. Therefore circled names have been removed from card deck for all 4 groups.

APPENDIX F

PRINCIPAL AND TEACHER REACTIONS

Project SEED Evaluation

Herbert C. Karsten
Principal
Willard School

The SEED program had many positives in the Willard School setting. These strengths were not only beneficial to pupils and teachers, but in addition helped provide a better learning climate and image for this school.

In my observations, I did see many normally non-involved pupils with a negative image of themselves participate wholeheartedly and enthusiastically in this program. There were outward indications of pupil learnings, and at the same time full involvement by the child.

Staff members gained by observing the competencies of the various SEED teachers and their various approaches to have children "discover" new learnings. It was a fine "in-service" for them, as they watched the interaction and involvement of pupils in their newly discovered learnings. At the same time it helped teachers observe first hand some of the "cultural drawbacks" children have due to living in a "ghetto" and having a home environment that is not educationally oriented. The pupils spontaneous responses and sometimes complete involvement in the learning process gave staff members the insight that these pupils had more potential than is normally seen in a regular everyday classroom program.

Parents of children in this project this year were as enthused as their children. This was gleaned from personal contacts, and requests that their children continue on at Willard even though they had moved to other school districts miles away. Parents positiveness (which was not always true at Willard) to their childs enthusiasm and positiveness to this program has done much to improve the image and climate for learning at this educational establishment.

The SEED staff involved, exhibited a high degree of knowledge and proficiency in teaching the subject matter, but also had the skills to make learning exciting through their techniques and approaches toward "discovering".

As principal, I felt the program organization, self evaluation and coordination by Dr. Tom Post was well done and efficiently handled. I'm sure some internal problems (University level) had to be resolved, but these were effectively handled outside the school setting.

The SEED program was, in the 1970-71 school year, one that provided the pupil and staff at Willard School a tremendous learning and growth experience. I hope that this program with other children and staff will be continued in the 1971-72 school year.

Project SEED Evaluation

Michael Doody
Grade 6
Willard School
Seed Classroom October 1970-May 1971

It is my firm belief that the SEED program has been a great ego booster for our kids at Willard. This is but one reason I hope the program is continued. It is also my opinion that the program will in actual fact cause a great number of our kids to go on to higher math (or at least give higher math a try in their future higher educations). The program also builds great confidence in our kids, as well as doing away with all "fear" of higher math.

The program does wonders in creating interest in (or for) higher math and education in general. In my opinion the SEED program must be continued.

Project SEED Evaluation

Barbara Held
Grade 5
Willard School
Seed Classroom October 1970 - May 1971

As a whole SEED was a good addition to my classroom. I saw two distinct examples of where SEED improved self esteem. These two girls had much more of a feeling of worth. One of the effects SEED had on the class as a whole was it strongly implanted in the kids the possibility and need to question. SEED was an exercise in thinking with all possibilities at answers - anything that makes kids think, truly think, is great!

Leonard Shapiro who worked with my class is a master at the discovery method. He had a whole basketful of gimmicks to bring the kids in and get them involved - one minute it's whispering the answer in his ear, the next it's the kid being the teacher at the board. Leonard was really great to work with. He called me often during the week at home to discuss problems and successes. This really helps to keep in close contact. It was great watching him work.

With the successes whould also be mentioned the problems. First of all I feel that 45 minutes is too long to keep the kids involved. I strongly feel 30 minutes would be much better. I also feel that the discipline in the classroom should be handled totally by the SEED person after much discussion with the teacher before the SEED person ever steps into the classroom.

Project SEED Evaluation

Gary Chesner
Grade 5
Willard School
Seed Classroom October 1970 - May 1971

In my opinion project SEED was very successful in my classroom. It seemed to be particularly beneficial for average students and low students. These children seemed to be motivated by the sheer mathematics of the program. I am convinced that these children, who were normally below average students, imporved their self-image and built confidence in themselves and in their ability to cope with some difficult mathematics. One of SEED's goals was to improve the child's self-image. In many cases I believe it met that goal.

If SEED continues I would like to see a more sequential approach where the children build on what they've learned.

So much of SEED's success depends on the instructors and their relationship with the children, therefore it is absolutely necessary to have people who are skilled and willing to participate. The instructors in the 70-71 season were a large reason for SEED's success.

Project SEED Evaluation

Brian Thomas
Grade 3
Willard School
Seed Classroom February 1971 - May 1971

The SEED program was of a great benefit to my student's educational program this year. They gained a much broader insight in mathematics especially as compared to what is normally presented in their curriculum.

They also achieved a little better understanding of their own worth and a somewhat better acceptance of each other. I feel the SEED program in my classroom was a definite asset.

Project SEED Evaluation

Joan Mills
Grade 4
Willard School
Seed Classroom February 1971 - May 1971

Overall, I felt SEED was an excellent addition to my classroom. Professor Eugene Fabes did a marvelous job. I recommend him highly. Of course, you know that not all students were interested all the time, but we found there was no student who was not involved at any time. This I found amazing. Even very slow or seemingly disinterested students were very excited at times. Students were also in and out during a given hour. We also found that even though our class appeared somewhat chaotic at times, the kids were learning the concepts being taught them.

The method of teaching is of utmost importance. I really feel that for SEED to succeed, you have to use the discovery method of teaching only. My students were not interested at all in outright lectures. The instructors you choose must know how to use this teaching method or observe it being used for a length of time. I personally lean toward straight discovery without any gimmicks to amaze the students.

The time factor will also be important for SEED. A definite time should be set aside only for SEED and preferably not next to the regular math time. I feel that three days (consecutive) is very adequate. Four or five days weekly is too much for the kids. They need a break. SEED also takes a big chunk out of the regular school day. The classroom teacher needs the time to complete her regular duties.

It is very important for the regular teacher as well as the SEED teacher to know what is going on during the SEED class. This is definitely not prep time for a teacher. I learned a great deal about my students by being able to sit back and watch them interact with another teacher and among themselves.

The two teachers should be very open with criticism both good and bad. There should be constant communication between teachers. Teachers should volunteer for SEED. Never should it be put in a room where the teacher does not want it.

One of the SEED goals was to change the self concept of some students. I found with many students this was happening. The children were not afraid to answer questions for fear of being laughed at or getting the answer wrong. I won't go into case studies, but I feel every child was touched by this free atmosphere.

A great concern of mine is that a program has to be carried through. The material has to change and challenge the students. If you go into the fifth grade next year and present the same material over (remember some will have had SEED and some won't) you will have trouble. I feel that it should be continued, but to be careful how it is done.

SEED did an amazing job with many of my students. I feel the program is well worth the time it takes. I would very much like to have it in my classroom again if I was teaching in Minneapolis. The children are thinking during SEED. Many times we don't really teach them how to think. SEED does. If you need any more information or answers to specific questions please feel free to contact me.

The Minneapolis Seed Mathematics Specialist Project. The Pilot 1970-71.

PROGRESS REPORT
INTERCULTURAL PROGRAMS

The Minneapolis Seed Mathematics Specialist Project. The Pilot 1970-71. Willard School, Minneapolis Public Schools. By Thomas R. Post. (no date)

PROGRESS REPORT
INTERCULTURAL PROGRAMS